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THE POISONOUS PLANTS OF THE U. S. ATOMIC ENERGY COMMISSION'S NEVADA TEST SITE, NYE COUNTY, NEVADA

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By Kenneth W. Brown and Donald D. Smith, DVM
of the
Bioenvironmental Research Program
Southwestern Radiological Health Laboratory
U. S. Public Health Service
Department of Health, Education, and Welfare
Las Vegas, Nevada

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Chapter 1
INTRODUCTION

This report is a reference for identification of poisonous plants found on the Atomic Energy Commission's (AEC) Nevada Test Site. It was compiled for the Farm Support Section and the Animal Investigation Program of the Bioenvironmental Research Program, Southwestern Radiological Health Laboratory, as an aid in determining range sites for the AEC beef herd which grazes on the Nevada Test Site and as an aid in the investigation of off-site livestock losses.

Plant species which are included in this report have wide distribution throughout the southwestern United States. Many are commonly distributed in the warm deserts of California, Nevada, and Arizona, also, many are distributed throughout the Great Basin of northern Nevada and southern Utah. Only those plants commonly found on the Nevada Test Site are included in this report.

Identification of plants by various physical characteristics are included in the appendix to aid those individuals who are unfamiliar with the various plant species. Various other tables included are types of poisonous principles, symptomatology, and species of animals affected. Because the user of this report may not be familiar with all terms used in the report, a glossary is also incorporated.

The scope of this report is limited to brief, concise, and pertinent details of the physical description, distribution, habitat and poisonous principle of the plant and symptomatology, pathology, and treatment of the affected animal.

Chapter 2

CHENOPODIACEAE

2.1 ATRIPLEX CANESCENS (PURSH) NUTT (Four Wing Saltbush)

2.1.1 Description. Four Wing Saltbush is a grayish-white, scurfy perennial, occasionally reaching a height of 6 to 10 feet. The leaves are alternate and somewhat clustered, stalkless and narrow (about 3/8 inch wide and 2 inches long). The male and female flowers are usually borne on separate plants near the end of the branches. The fruit is one-celled and has four conspicuous wings or bracts.[14]

2.1.2 Distribution and Habitat. It is most commonly found growing in sandy soils on dry hillsides and in desert washes. This species is most prevalent in the Larrea-Franseria and the Coleogyne plant communities between 3000 and 6000 ft. elevation. It is common in all basins and is the dominant shrub in South Frenchman's Flat.[5]

2.1.3 Poisonous Principle. This shrub is a secondary or facultative selenium absorber thus accumulating selenium when growing in seleniferous soils.[16] It is especially preferred as a grazing plant during its flower and fruiting stages. Animals most likely affected would be cattle and horses during the summer and spring months.

2.1.4 Symptomatology and Pathology. Selenium toxicity may be manifested as one of three syndromes, depending upon the level of selenium in the diet. An acute and two chronic forms of poisoning have been recognized. Because levels of selenium accumulated by Atriplex are usually insufficient to cause acute selenium toxicity, only the two chronic forms are observed. "Alkali Disease", one of the chronic forms, usually appears in animals grazing for a month or longer upon plants containing 5-40 ppm selenium.[16] "Blind Staggers", another chronic form, appears after a week or more of grazing on plants containing less than 200 ppm selenium but more than 100 ppm.

Symptoms of "Alkali Disease" are inappetence, emaciation, lack of vitality, anemia, stiffness and severe lameness. Cattle and horses show early loss of long hair from the base of the tail and switch being called "Bob-tailed disease" in horses.[10] Hoof deformaties cause severe lameness. Cracks appear at the coronary band and a band of dead tissue results. As new coronary growth occurs, this break moves downward and the old portion of the hoof may separate or slough off or it may result in ragged deformed hoofs 6 - 7 inches long which are turned up at the ends. Congenital hoof deformaties may occur in the newborn if the dam has received a diet containing an excess of selenium during gestation.

The "Alkali Disease" type of selenium poisoning is not common in sheep.[25]

The "Blind Staggers" syndrome is manifested in three clinical stages. In the first stage, the animal tends to wander from the herd as vision is impaired to such an extent that the animal may disregard objects in its path or stumble over them. Although temperature and respiration are normal, the animal shows inappetence. During the second stage the afflicted animal will circle

aimlessly trying to walk over or through objects in its path. Front leg lameness and further impairment of the vision becomes evident. Respiration and temperature remain normal but the inappetence disappears and a desire to ingest abnormal objects is observed.

Clinical signs during the terminal or third stage are increasing paralysis, especially of the tongue and the muscles responsible for swallowing, increased rate and labored respiration, subnormal temperature and acute abdominal pain. The animal becomes almost completely blind because of swollen eyelids and cloudy corneas. Death from respiratory failure occurs a few hours after the onset of the third stage.

Necropsy reveals the following lesions in "alkali disease": Atrophy and dilatation of the heart, cirrhosis and atrophy of the liver, glomerulonephritis, mild gastro-enteritis, erosion of the epiphyses of the long bones, and hoof lesions as described above. [10, 6]

Lesions of "Blind Staggers" are acute congestion and diffuse hemorrhage of the lungs, impacted rumen, hyperemia and necrosis of the epithelium of the abomasum and small intestine, parenchymal degeneration and focal necrosis of the liver, greatly enlarged gall bladder, nephritis, cystitis and acute congestion of the spleen. [10, 6]

2.1.5 Treatment. Stiffness of "alkali disease" has been relieved by oral administration of naphthalene at the rate of 4-5 gms daily for five days and repeated at a five day interval. [25]

Treatment for "blind staggers" is only successful if instituted prior to the third stage. Strychnine sulfate (4-6 mg/600-800 lbs) should be given at three hour intervals for a total of three doses. The animal should be drenched with up to 3 gallons of tepid water every 2-3 hours for 1-2 days. Neostigmine (1-2 mg/100 lbs I. M.)

given concurrently with daily intravenous glucose for at least 3-4 days has given favorable results.

2.1.6 Prevention. Removal of animals from the range is the best preventive measure. If this is not possible, the addition of 1.9 gm of sodium arsenite/100 lbs of salt which is fed free choice, is helpful.[10] A high protein diet has a general protective effect and should be given along with the additive.

2.2 ATRIPLEX ROSEA L. (Redscale)

2.2.1 Description. Redscale is an annual having many branches and spreading stems which are coated with a silvery scurf. The leaves are alternate, densely scurfy, often turn red and are ovate, coarsely-toothed or wavy margined. The seeds are flattened having convex sides, yellowish brown in color and wrinkled.

2.2.2 Distribution and Habitat. This species is found growing in alkaline soils, along roadsides and where the soil has been disturbed. It has been reported in Frenchman's Flat[5] and should be found in all lower basins 3000 to 4000 ft. in elevation as part of the Atriplex and the Larrea-Franseria plant communities.

2.2.3 Poisonous Principle. Atriplex rosea is a secondary or facultative selenium absorber, thus accumulating selenium when growing in seleniferous soils.[16] It is probably most harmful during its growing season, which is May through June. Animals

most likely to be affected would be ruminants such as cattle and sheep.

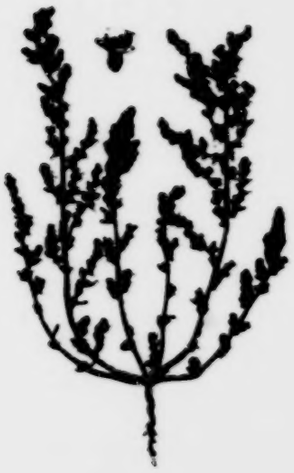
2.2.4 Symptomatology and Pathology. Symptoms and lesions observed are the same as those listed under section 2.1.4.

2.2.5 Treatment. Treatment is the same as listed under section 2.1.5.

2.2.6 Prevention. Preventive measures are the same as listed under 2.1.6.

2.3 HALOGETON GLOMERATUS (BIEB) C.A. MEY (Halogeton)

2.3.1 Description. Halogeton is a bush similar to Russian thistle, Salsola kali. The young leaf is generally greenish purple, smooth, shiny, fleshy, and sausage-shaped. The mature leaf is from 1/4 to 3/4 inches long, somewhat inflated toward the blunt tip; a solitary hair about 1/8 inch long, bristle-like, and somewhat curved, grows out of the extreme leaf tip.



Color of the stem is usually dark red to light purple. As the plant matures, the stem color fades and becomes straw-colored.

Halogeton reaches the flowering and fruiting stage by late summer. The flower, being small, can scarcely be seen without magnification. The fruit is often thought to be the flower. What appear to be petals are actually bracts of the black winged seeds. These are small, about 1/25 inch diameter, borne at the bottom of

the tube-like structure formed by bases of the five seed wings. Another type of seed is found on Halogeton that is larger, wingless, dark brown in color, and apparently has delayed germination.[9]

In Nevada a mature Halogeton plant varies from a few inches to two feet in height. Less growth is attained on dry sites or where the plant is growing in competition with other vegetation.[9]

2.3.2 Distribution and Habitat. The plant is characteristic of salty, bare and disturbed soils of the western desert ranges.[22] Range lands in Nevada infested with Halogeton are usually below 7,500 feet in elevation. Between 5,500 feet and 7,500 feet ranges are generally grazed during spring and fall, while ranges below 5,500 feet are ordinarily winter grazed.[9] Halogeton has been found growing on disturbed sites in the vicinity of the Frenchman's Playa on the Nevada Test Site.[4,5]

2.3.3 Poisonous Principle. Oxalate which is the poisonous principle in the plant is mostly in the form of a soluble sodium salt although small amounts of potassium and calcium oxalate may also be present. Soluble oxalates are built up to very high concentrations during the peak growth of the plant; the maxima having been observed from September to February. The green leaves and fruiting structures contain the greatest concentration. With maturity, a reduction in oxalate concentration is brought about by three mechanisms: -1- loss of leaves, -2- leaching by rain or snow, and -3- transformation of soluble to insoluble oxalates. Levels of soluble oxalates as high as 34.5 percent of the total plant composition on a dry-weight basis, have been detected. However, the average is usually within 18 to 28 percent.[16]

The plant is poisonous in all stages of growth; the amount of oxalate varies with season, locality and part of plant. However, the plant is usually so unpalatable that only under unusual circumstances will animals consume enough to produce poisoning.[7]

2.3.4 Symptomatology and Pathology. Under normal range conditions only sheep are affected, since it is unlikely that cattle will eat enough to be poisoned unless feed is scanty. Twelve to eighteen ounces of the green plant will cause acute poisoning of mature sheep. Symptoms which appear 2-6 hours after ingestion of a lethal dose are due to the absorption of the soluble oxalates into the blood stream causing a drop in serum calcium levels. These include dullness, colic, depression, dyspnea, prostration and coma. Death occurs about 10 hours after ingestion.

Post mortem findings include pulmonary hyperemia and emphysema, diffuse and petechial hemorrhages throughout the digestive tract and pericardium, ascites, and pleural effusion. An outstanding lesion is usually noted in the kidneys which are dark red in color. The cortex and medulla are clearly separated by an accumulation of oxalate crystals.

2.3.5 Treatment. No specific treatment for affected animals is recommended. Calcium gluconate I. V. has a temporary beneficial affect. Palliative treatment of animals should include ample fluids to decrease the precipitation of oxalate crystals in the urinary tract.

2.3.6 Prevention. If other desirable forage is available and if animals select their own feed, they will seldom eat toxic amounts of the plant. Grazing management that maintains native plants in

vigorous condition or reseeding of infected areas with native grasses, prevents heavy infestation of halogeton. 2,4-D at the rate of 2 lbs/ acre will kill over 90% of the current season's plants.

Supplemental feeding of 1/4-1/2 lb of alfalfa per day will prevent the animal from eating toxic amounts of the plant. Dicalcium phosphate fed free choice is given as a prophylactic. Salt should be available at all times.

2.4 SARCOBATUS VERMICULATUS (HOOK) TORR. (Greasewood)

2.4.1 Description. This species is a perennial spiny plant usually reaching a height of three to five feet, although individual plants of eight feet are often encountered. The leaves are bright green, narrow, and fleshy being almost round in cross section. There are two kinds of flowers, male and female. The male flowers are small and have somewhat of a cone-like appearance; the female flowers are single and become wing-like and much enlarged in fruit. [23]

2.4.2 Distribution and Habitat. Greasewood is commonly found in the Western United States. It grows principally in the heavy saline to saline-alkaline soils of semi-arid regions. It is found on flood plains, along dry washes and gullies, in areas where the soil is sufficiently moist and on and near Groom Playa on the Nevada Test Site, at an elevation of about 4,500 feet. [5]

2.4.3 Poisonous Principle. Toxicity is due to the high content of sodium and potassium oxalates. Analyses indicate that the total oxalate content of greasewood leaves varies between 10 and 22 percent on a dry weight basis, and exists mostly as soluble salts.[19] Oxalate content is greatest in the leaves compared with other parts of the plant and increases with maturity, reaching a maximum in August and September. The amount of plant necessary to produce poisoning varies with its soluble oxalate content, time period of ingestion, size of animal (sheep seem to be affected more than cattle) and presence or absence of other material in the digestive system.

In the spring, trail grazing sheep in heavily infested areas of greasewood may result in tremendous losses.[23] Two pounds of the green leaves and fine stems, if consumed in a short period of time and without other types of forage, will result in death.

2.4.4 Symptomatology and Pathology. Symptoms and lesions are the same as listed in section 2.3.4.

2.4.5 Treatment. Treatment is listed under section 2.3.5.

2.4.6 Prevention. Poisoning is likely to occur only in the spring, as the young tender foliage is quite palatable. During this season sheep should be kept out of greasewood ranges, or be supplied with supplemental feeding such as grain or alfalfa hay pellets containing at least 10% dicalcium phosphate.

Annual treatments of the range with 2,4-D will control the shrub. Eradication is probably not desirable as it is a valuable forage plant for cattle and sheep during the winter months. Salt should be available at all times.

Chapter 3

COMPOSITAE

3.1 BAILEYA MULTIRADIATA (HARV. AND GRAY) (Wild Marigold)

3.1.1 Description. Wild marigold is a low growing plant densely covered with short hairs which give it a woolly appearance. It has numerous, alternate, toothed leaves on numerous basal branches. The prominent yellow-flowered heads on elongated stems are present from spring until late fall.[24]

3.1.2 Distribution and Habitat. This species is commonly found on sandy soils in the Larrea Franseria plant community. It has been observed on disturbed sites and dry slopes at 3000 to 4000 feet elevation. It is commonly found in all of the lower basins and along the roads throughout the Nevada Test Site.

3.1.3 Poisonous Principle. The toxic principle is unknown, however, the plant is known to be toxic to sheep and goats during all stages of plant growth. There have been no proven cases of poisoning in cattle and horses. An animal must ingest large quantities of the plant over a relatively long period of time. It was reported that 41 lbs. (green weight basis) within a 25 day period produced death in sheep.[16]

3.1.4 Symptomatology and Pathology. Initial symptoms are excessive salivation (frothy green in color), depression and anorexia. Affected animals become sluggish and appear weak. When forced to

move they exhibit incoordination, muscular trembling and a rapid heart beat which is audible for several feet. Hemoglobinuria and pneumonia have been reported in some afflicted animals. Death occurs several days to weeks after onset of the initial symptoms. Autopsy reveals widespread petechial hemorrhages and edema. Occasionally there are subepicardial hemorrhages with degenerative changes in the liver and/or kidney. Albuminuria may result from hyalin in the renal tubules. Gastroenteritis and ascites are commonly found.

3.1.5 Treatment. There is no specific treatment. Animals should be removed from the range and supplemented with good hay. Most animals will slowly recover if treated symptomatically and given good nourishment.

3.1.6 Prevention. Since animals eat Baileya only when range forage is lacking, provision of supplemental feed or movement to better pastures will usually prevent poisoning. Proper management to maintain desirable range forage should eliminate the problem. 2,4-D spraying of the range is effective if done following rains.

3.2 CHRYSOTHAMNUS NAUSEOSUS (PALL) BRITTON (Rabbitbrush)

3.2.1 Description. This species is a perennial shrub growing to a height of 6 feet, having many branched and often ill-smelling fibrous-barked main stems from the base. The leafy twigs are clothed with a persistent felt-like, gray, white or greenish tomentum. The leaves are linear filiform to narrowly linear-oblanceolate measuring 2 to 7 cm long and 0.5 mm wide. The flowers are usually yellow.[2]

3.2.2 Distribution and Habitat. It is most often seen in lower desert washes from 3000 to 4500 ft. in elevation and occasionally higher. It grows in sandy to alkaline soils and is commonly found in the Larrea-Franseria and Coleogyne plant communities. This species is fairly common in most of the low elevation desert drainages throughout the Nevada Test Site.

3.2.3 Poisonous Principle. Preliminary feeding experiments showed that this species is toxic to all livestock. However, the toxic principle is unknown at this time.[16] The spring and summer months are regarded as the most dangerous seasons.

3.2.4 Symptomatology and Pathology. A search of the literature has not revealed any information concerning symptoms or pathology.

3.2.5 Treatment. No specific treatment is known.

3.2.6 Prevention. Since the plant is unpalatable it may be assumed that with proper range management there should not be any problem.

3.3 GUTIERREZIA MICROCEPHALA (DC.) GRAY (Broomweed)

3.3.1 Description. This species is a densely branched perennial resinous shrub, usually growing to two feet in height. The main stems are woody, bearing numerous herbaceous leafy branches on which the lower leaves are shed at maturity. The leaves are numerous, alternate, linear, reflexed from the stem and range from 3/4 to 2 inches long.[16]

3.3.2 Distribution and Habitat. Broomweed is commonly found growing in sandy

to semi-sandy soils usually in areas of improper range practices. It is common in Coleogyne, Artemisia, Artemisia - Pinon - Juniper plant communities of Forty-mile Canyon, washes of Southwest Frenchman, and in the vicinity of Cane Springs.[5]

3.3.3 Poisonous Principle. Extracts from this plant yield saponin which is most toxic in the stage of leaf formation. Sheep and cattle are especially susceptible under range conditions.[16]

3.3.4 Symptomatology and Pathology. The most common result of poisoning is abortion although death may result in acute cases. Cows may abort in various stages or produce weak underweight calves. Retained placenta is a sequel to the birth or abortion. Cows that do not abort may exhibit periodic vulvar swelling and premature preparturient udder development.

Symptoms in severely poisoned sheep and cattle include listlessness, anorexia, rough coat and hematuria. Cattle may also have a desquamating muzzle accompanied by a nasal discharge. Sheep occasionally show generalized icterus.

Autopsy reveals degenerative changes in the liver and kidneys and gastroenteritis. The subcutaneous fat and connective tissue may show icterus. The uterus is edematous and hydrops may be observed in the fetal membrane.

3.3.5 Treatment. No specific treatment is known. Animals should be removed from the range and given supplemental feed.

3.3.6 Prevention. Other forms of dry feed should be given to animals grazing on broomweed infested ranges. The herbicide 2,4-5-T has been used to decrease the population of the plants with favorable results.

3.4 GUTIERREZIA SAROTHRAE (PURSH) BRITT. AND RUSBY (Snakeweed)

3.4.1 Description. This species is a low, erect perennial that grows to a height of 18 inches. The leaves are alternate, simple, long and thread-like. The yellow flowers are found clustered in small bunches.[18]

3.4.2 Distribution and Habitat. It grows in sandy soils and usually is seen along roadsides and on disturbed sites. It is common in the Larrea-Franseria plant community and has been found growing in the Forty-mile Canyon basin.[5] This species is fairly common throughout the Nevada Test Site at 3000 to 4500 ft. in elevation.

3.4.3 Poisonous Principle. Snakeweed is a secondary or facultative selenium absorber, thus accumulating selenium when growing in seleniferous soils, being most dangerous during the period of first growth during the spring and summer months.[16] Cattle, sheep and goats have been poisoned by this plant.[18]

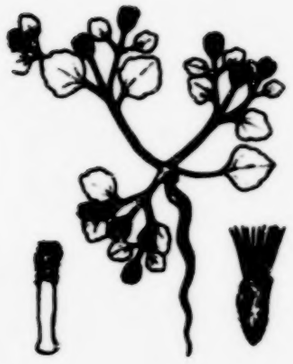
3.4.4 Symptomatology and Pathology. Symptoms and lesions are the same as listed under section 2.1.4.

3.4.5 Treatment. Treatment is the same as listed for section 2.1.5.

3.4.6 Prevention. Preventive measures are the same as listed for 2.1.6.

3.5 PSATHYROTES ANNUA (NUTT) GRAY (Paper Flower)

3.5.1 Description. This species is somewhat openly branched at the base. It is one to six inches high and 1-1/3 times as broad. The leaves are scurfy-pubescent and fanshaped. The flowers . . yellow to purple in color.[13]



3.5.2 Distribution and Habitat. It is found in dry, sandy and often alkaline soils, especially creek beds and dry washes. It has been reported on disturbed sites in Rock Valley, Jackass, Frenchman and Yucca Flats.[5] Plants are common in the Larrea-Franseria and Coleogyne plant communities at elevations 3000 to 6000 ft. However, it has been found at higher elevations.[2]

3.5.3 Poisonous Principle. The poisonous principle is unknown. Experimental feedings of 1% body weight have proved that single doses are lethal to sheep in less than 24 hours. The plant may be eaten by cattle under adverse range conditions, but no natural cases of poisoning have been reported.[16] The species is most toxic during the spring and summer months.

3.5.4 Symptomatology and Pathology. Sheep, following toxic doses, exhibit signs which include general weakness, incoordination, and depression followed by coma and death. If sheep are fed sublethal doses daily, icterus develops.[16]

On autopsy, the liver is swollen, friable and has a nutmeg appearance. On microscopic examination bile ducts are distended and few normal hepatic cells are found.

3.5.5 Treatment. There is no specific treatment for this condition.

3.5.6 Prevention. Good range management is the best preventive measure, as animals will not eat this plant if more palatable grasses and forbs are available.

3.6 SENECIO INTEGERRIMUS NUTT (Groundsel)

3.6.1 Description. This species is a perennial that grows to a height of 3 feet. The lower leaves are mostly ovate or obovate, entire to dentate. The relatively few composite heads are in terminal flat-topped open clusters and are yellow to a creamy white.[16]

3.6.2 Distribution and Habitat. It has been reported to be in the Artemisia-Pinon-Juniper plant communities[5], being rare to occasional at levels from 5000 to 6500 feet elevation.

3.6.3 Poisonous Principle. Senecio alkaloids belong to a single group, the pyrrolizidine alkaloids. On hydrolysis these alkaline esters break apart to yield a nitrogen-containing fraction called necine. Necine in sufficient quantity may produce death in sheep, goats, cattle, hogs, and horses. The plant is not preferentially grazed, but is utilized when more desirable forage plants are not available.[16] It is most toxic during the spring and summer months.

3.6.4 Symptomatology and Pathology. Doses of 1 to 5% of an animal's weight fed at one time or over a few days will cause acute poisoning. Ingestion of small daily doses over a period of several weeks will result in chronic poisoning.[16] Cattle and horses are equally sensitive to the toxic effects but sheep are more resistant and require roughly twice as large a dose for the same effect.

Symptoms appear abruptly and usually terminate in death within a week. There is icterus of mucous membranes, a peculiar sweetish unpleasant odor from the skin and milk, weakness, uneasiness, abdominal pain, emaciation and depraved appetite. Animals may die quietly or restlessness may increase. The animal may wander aimlessly, stagger, have a staring expression and run into fences or other objects. They may lean or push against these objects and become hyperexcitable. A prolapsed rectum may be present as a result of tenesmus associated with diarrhea.

Lesions are almost entirely the result of specific hepatic injury produced by the Senecio alkaloids. There is hepatic cirrhosis, edema of the visceral peritoneum and distention of the gall bladder. There may be degenerative changes in the kidneys of cattle.

3.6.5 Treatment. Treatment is of uncertain value but provision of high intake of carbohydrates by forced oral or intravenous feeding may help the animal during the period of severe liver dysfunction. Treatment of race horses with crystalline methionine has proven effective.[16]

3.6.6 Prevention. Good range management that provides adequate grasses and forbs will prevent a toxicity problem from arising as groundsel is not very palatable. The herbicide 2,4-D in its ester form is effective for destroying the plant in pasture land.

3.7 SENECIO SPARTOIDES T AND G (Broom Groundsel)

3.7.1 Description. This species is a coarse and bushy perennial that is scurfy throughout. It is 6 inches to two feet tall. The leaves are mostly entire, narrowly linear and up to 3 inches long. The flowers are mostly yellow.

3.7.2 Distribution and Habitat. It is common in the Artemisia - Pinon-Juniper plant communities in Silent Canyon and on Pahute Mesa.[5] It may be found in areas from 5000 to 6500 ft. elevation and in soil types classified as stony sandy loam.

3.7.3 Poisonous Principle. The poisonous principle, necine, is identical to that found in Senecio integerrimus.

3.7.4 Symptomatology and Pathology. Senecio spartoides is slightly more toxic than Senecio integerrimus. Symptoms and lesions are the same as those listed under 3.6.4.

3.7.5 Treatment. Statements made in section 3.6.5 apply here.

3.7.6 Prevention. See comments listed under section 3.6.6.

3.8 TETRADYMIA CANESCENS (D.C.) (Spineless Horsebrush)

3.8.1 Description. The stems and leaves of this perennial are covered with dense, persistent woolly hair which imparts a whitish cast. The leaves are alternate, single, linear and about one inch long.[16]

3.8.2 Distribution and Habitat. Tetradymia canescens is common

on sandy and rocky hillsides and plains 4000' to 7000' elevation in the southwestern deserts.[13] It is commonly found in the Artemisia-Pinon-Juniper plant community on the Nevada Test Site. It has been found on Rainier Mesa and in Forty-mile Canyon basin.[4]

3.8.3 Poisonous Principle. The poisonous principle is unknown. Feeding experiments have shown that it is toxic to sheep especially during the spring to fall months.[16]

3.8.4 Symptomatology and Pathology. Symptoms will either be those of acute toxicity or those of photosensitization called "Bighead". In acute toxicity, symptoms begin 16 to 24 hours after consumption of the plant. Affected sheep lag behind the flock and show anorexia, depression, muscle twitching, incoordination, extreme weakness, prostration, convulsions, coma and death. If animals survive longer than 3 days, they usually develop signs of photosensitization. There is redness and swelling of the skin of the face, lips, ears and submandibular space, itching and uneasiness. The ears hang down due to increased weight, serum oozes from the swollen areas dries and results in a mass of scabs. Eyes become intensely inflamed and blindness may result.

Animals that die of acute toxicity show a markedly enlarged and engorged liver. Occasionally the capsule has ruptured due to the extensive hemorrhage. There are marked degenerate changes in the liver on histopathology. No icterus is observed. The gall bladder is distended, kidney shows low grade nephritis, and there may be petichial hemorrhages in the subcutis. Necropsy examination of "Bighead" presents a similar picture except the liver shows more advanced fatty degeneration and may be smaller than normal.

3.8.5 Treatment. Affected sheep must be removed from the range and sunlight, kept in the shade, treated with antihistamine and allowed to graze only at night.

3.8.6 Prevention. Tetradymia is not palatable to sheep and is relatively non-toxic when mature. Therefore, poisoning usually occurs while trailing the sheep from winter range to summer ranges. Herders can prevent losses by avoiding spineless horsebrush ranges while trailing sheep and by not permitting the animals to graze in the infested areas immediately after watering. Supplemental feeding at this time will prevent ingestion of the plant. Practical methods of eradication have not been developed.

3.9 TETRADYMIA GLABRATA (GRAY) (Little-Leaf Horsebrush)

3.9.1 Description. This shrub has leaves of two types; the primary leaves are sharply pointed and slightly less than 1/2 inch long and the secondary leaves are clustered in angles of shed primary leaves, fleshy, blunt-typed, and slightly less than 1/2 inch long. The flowers are yellow in color.[16]

3.9.2 Distribution and Habitat. Tetradymia glabrata has been reported in Mid Valley, Yucca and Forty-mile Canyon in the Grayia lycium, Coleogyne, and Artemisia plant communities.[5]

3.9.3 Poisonous Principle. The poisonous principle is unknown. However, feeding experiments have shown that it is toxic to sheep at about 0.5 percent of the animal's weight, whether given in one feeding or in lesser amounts repeatedly over a longer period of time. Attempts to poison cattle experimentally have not been successful.[16] The species is most toxic during the spring to fall months.

3.9.4 Symptomatology and Pathology. Symptoms and lesions are identical to those described under section 3.8.4.

3.9.5 Treatment. Treatment is the same as described under section 3.8.5

3.9.6 Prevention. Preventive measures are identical to those described under section 3.8.6.

3.10 TETRADYMIA AXILLARIS A. NELS. (Horsebrush)

3.10.1 Description. This is a shrub that grows up to three feet in height. The leaves are about one cm long. Conspicuous straight spines on the stems are at least 1.5 cm long and occasionally longer.

3.10.2 Distribution and Habitat. Tetradymia axillaris has been reported as being occasional in the Grayia-lycium, Coleogyne, Artemisia and sometimes in the Larrea-Franseria plant communities.[5] It usually grows in a sandy to a sandy loam type of soil from 3000 to 4500 ft. in elevation.

3.10.3 Poisonous Principle. The poisonous principle of this species is unknown, however, feeding experiments have shown that it has the capacity for producing photosensitization in sheep.[16] The plant is especially toxic during the spring and summer months.

3.10.4 Symptomatology and Pathology. Symptoms and lesions are identical to those described under section 3.8.4.

3.10.5 Treatment. Treatment is the same as described under section 3.8.5.

3.10.6 Prevention. Preventive measures are the same as described under section 3.8.6.

Chapter 4

CRUCIFERAE

4.1 DESCURAINIA PINNATA (WALT) BRITTON (Yellow Tansy Mustard)

4.1.1 Description. Yellow tansy mustard is an annual that grows up to two feet tall. The stems and leaves are covered with a fine pubescence which gives the plant a whitish appearance. The flowers are small with four spreading yellow to yellowish-green to white petals.

4.1.2 Distribution and Habitat. The plant is widely distributed throughout the southwestern United States, forming heavy stands on dry sandy soils in arid regions. It is much more abundant during the summers that follow moderate winter rains. This species is fairly common in the lower basins throughout the Nevada Test Site, especially in the Larrea Franseria plant community at elevations from 3000 to 4000 feet.

4.1.3 Poisonous Principle. The poisonous principle is unknown. Despite similarity of the symptoms with those produced in one type of selenium poisoning, selenium content found in the plant is insufficient to produce the disease.[16] Poisoning usually occurs in cattle on range lands in the southwest where the diet consists almost entirely of this plant.

4.1.4 Symptomatology and Pathology. Symptoms of tansy mustard poisoning, referred to as "paralyzed tongue", are similar to those observed in the "Blind Staggers". There is a partial or total blindness accompanied by inability to use the tongue or to swallow. Animals wander

aimlessly or push against objects. They may stand by water but are unable to eat or drink. Animals gradually become emaciated, weakened and eventually die if not treated.

4.1.5 Treatment. Treatment is simple and effective. Animals are removed from the range, given water and nutrients twice daily via stomach tube. As the digestive system starts to function, symptoms gradually disappear.

4.1.6 Prevention. Because toxicity only appears when the diet is predominantly that of tansy mustard, careful range management and herbicide application will prevent a heavy infestation and therefore prevent any occurrence of poisonings.

4.2 STANLEYA PINNATA (PURSH) BRITTON (Desert Plume)

4.2.1 Description. This species is a native, perennial, half-shrub having a woody crown and several stout spreading stems that may reach a height of two feet. Its leaves are large, pale-green and somewhat thickened, fleshy, and located mostly on the lower half of the stem. Brilliant plumes of yellow flowers on the upper part of the main stems produce a number of narrow twisted seed-pods.[18]

4.2.2 Distribution and Habitat. This species is principally found in sandy washes, though not confined to them, at elevations from 3000 to 4500 ft. A moderate number of plants are found growing on the cattle range area of the Nevada Test Site. It is also abundant with Atriplex canescens on and near Frenchman's Flat.[5]

4.2.3 Poisonous Principle. The poisonous principle is selenium. The presence of the plant is perhaps the best indicator of selenium in the soil because selenium is always present where this species grows.[16] All grazing animals are in danger from this species, especially during the spring and summer months.

4.2.4 Symptomatology and Pathology. Ingestion of sufficient amounts of the plant may cause the same symptoms as listed in section 2.1.4. Under forced feeding conditions acute selenium toxicity may result. Symptoms of acute toxicity are uncertain gait, labored respiration with froth at the mouth, dilated pupils, and prostration. Death is due to respiratory failure occuring in a few hours. Lesions would be those associated with respiratory failure, e.g., pulmonary edema, congestion and endocardial hemorrhages.

4.2.5 Treatment. No satisfactory treatment is available for acute selenium poisoning. However, the treatments listed in section 2.1.5 should be attempted, if feasible.

4.2.6 Prevention. This plant is not palatable and will not be eaten if the range is in good condition. Grubbing of plants and spraying with one tablespoon of 2,4-D/qt. of water will prevent growth.

Chapter 5
FAGACEAE

5.1 QUERCUS GAMBELII (NUTT) (Gambel's Oak)

5.1.1 Description. This species is a native perennial, woody shrub or small tree that may reach a height of 15 feet and is sometimes referred to as scrub oak. It has the characteristic oak leaf and acorns like those of other oaks that have nuts partly enclosed in a rough cup.[18]

5.1.2 Distribution and Habitat. Scrub oak grows on foothills and low mountain ranges of the southwestern United States.[23] It is most common in the Pinon-Juniper woodland and Chaparral range types.[14]

Oak is noted to be common in the Pinon-Juniper communities on the Nevada Test Site, growing between 5000 to 6000 ft. in elevation.

5.1.3 Poisonous Principle. Toxicity of oak is attributed to its tannin content.[16] Sheep and cattle losses usually occur in the spring of the year when the oaks are showing young green leaves, buds and blooms.

5.1.4 Symptomatology and Pathology. More than 50% of the diet must consist of immature oak parts in order for poisoning to occur.

Poisoned animals are gaunt, weakened and show a tucked up abdomen. They tend to remain near water and in the shade as the animals have excessive thirst and frequent urinations. There is severe constipation with terminal diahrrea, the feces being dark, mucoid and bloody. Death occurs 3 to 10 days after symptoms occur.

Lesions are principally those of hemorrhagic gastroenteritis and nephritis. The kidney is swollen and pale with some petechial hemorrhage. Subcutaneous edema is common and large amounts of fluid are found in the body cavities.

5.1.5 Treatment. There is no specific antidote. The animals should be removed from pasture, given liberal amounts of water and magnesium sulphate via stomach tube and provided with easily digestible food.

5.1.6 Prevention. Supplemental feeding of alfalfa during the danger period will prevent poisoning as relatively large amounts of oak must be ingested for toxicity to occur. Excessive oak growth may be controlled by chemical methods.

Chapter 6

FUMARIACEAE

6.1 CORYDALIS AUREA (WILLD) (Fitweed)

6.1.1 Description. This winter annual is 4 to 16 inches in height and branches from the base. The flowers are golden yellow 12 to 15 mm long. The spur is about half as long as the petals.[1]

6.1.2 Distribution and Habitat. It has been found on Bald Mountain and on Groom Lake[5], growing in a sandy to sandy loam type of soil. The elevational range and the vegetation types seem to be quite variable.

6.1.3 Poisonous Principle. The poisonous principles are isoquinoline-structured alkaloids. Plants containing these alkaloids have been suspected of causing losses in sheep and cattle especially during the late winter and early spring months.[16]

6.1.4 Symptomatology and Pathology. Feeding experiments show consumption of 2% of the body weight of the plant will produce acute toxicity and 5% will cause death.[16] Principla symptoms are depression, accelerated pulse and respiration, twitching of the facial muscles, aimless movement, staggering, convulsions, prostration and death. Sharp stimulation during the convulsion immediately results in muscular rigidity. A characteristic symptom is the chewing of any foreign object within reach. Lesions are not specific and consist chiefly of congestion and irritation of the gastrointestinal tract.

6.1.5 Treatment. No specific antidote is known. Supplemental feeding and removal from range are the only recommendations that can be given.

6.1.6 Prevention. Spraying with herbicide, mechanical grubbing and good range management will keep the greater majority of growth to a minimum. Because the plants are quite palatable, shaded areas where it grows should be fenced.

Chapter 7
LEGUMINOSOE

7.1 ASTRAGALUS LENTIGINOSUS (DOUGL.) (Spotted Loco Weed)

7.1.1 Description. This species is a perennial, about one foot tall having branches radiating from the base. The stems are sparsely hairy or smooth, and have leaves that are 1 to 2-1/2 inches long. The flower bearing stems are shorter than the leaves. The flowers are densely crowded and white or purplish in color. The pods are broadly ovate, 2-celled, about 1/2 to 2/3 inch long, straw colored or purple-mottled, rather shiny and more or less grooved on each side.[21]

7.1.2 Distribution and Habitat. There are over 100 species of Astragalus found throughout the west. The plants are more widely distributed and more abundant than any other species of range plant.[22] This particular species grows from 3500 to 7000 ft. elevation on plains and mesas, usually in sandy soil, and is common in nearly all vegetation types and in most of the basins throughout the Nevada Test Site.[5]

7.1.3 Poisonous Principle. The toxic principle is unknown. An isolated substance gave a positive test with many of the standard alkaloidal reagents but did not meet all the characteristics of an alkaloid.[16] The substance was named "locoine". Not all species are poisonous; however, as a genus, loco weeds are probably as dangerous a group

of poisonous plants as occurs in the West. Some authorities rank them as the most destructive of all poisonous plants because they are poisonous to all species of livestock especially during the spring months.[22]

7.1.4 Symptomatology and Pathology. Symptoms in sheep and cattle appear after ingestion of approximately 90% of the animal's body weight over a period of 2 months. Death will result from ingestion of 320% of the body weight over 3 months. Horses are much more susceptible than either sheep or cattle.[16] Symptoms are emaciation, locomotor ataxia, nervousness, loss of sense of direction, weakness, muscualr tremor, withdrawal from other animals and often a violent reaction when disturbed. Hyperexcitability is more common in cows and horses and depression in sheep. Final stages are characterized by inability to eat or drink. Abortion is common.

Lesions are non-specific. There may be ulceration of the abomasum in the region of the pyloric orifice and generalized edema. Extensive edema of fetal membranes has been observed.

7.1.5 Treatment. There is no specific treatment. Removal of animals from the range to prevent addiction to the plant is necessary. If animals are prevented from feeding on this plant, they will usually slowly recover. The feeding of laxative feeds is of some value.

7.1.6 Prevention. As with most poisonous plants, range management so conducted as to insure an adequate supply of good forage is the most productive preventive measure. The growth is controlled by spraying the actively growing or budding plants with 2,4-D.

7.2 LUPINUS CAUDATUS (KELL) (Kellogg's Spurred Lupine)

7.2.1 Description. Range species are mostly low perennial shrubs. Leaves are alternate, palmately compound. The leaflets number 5 to 17 being mostly oblanceloate. The flower cluster is terminal, often showy, flowers are violet-blue to white in color and the fruit is a several-seeded, flattened legume pod.[16]

7.2.2 Distribution and Habitat. Lupines thrive under a variety of conditions, but they are especially abundant on sandy foothills, and pastures. This species has been found in the Artemisia - Pinon-Juniper plant communities on Rainier and Pahute Mesas, and also near Topopah Springs.[5]

7.2.3 Poisonous Principle. Many alkaloids have been isolated from the various species of Lupinus. The quinolizidine alkaloids are most commonly found, but some piperidine and other types of alkaloids may be found.

Sheep are most commonly affected under range conditions; however, cattle, horses, goats, swine and deer have been known to be poisoned.[16]

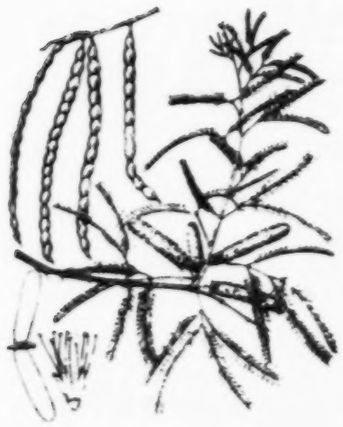
7.2.4 Symptomatology and Pathology. Signs of poisoning appear shortly after ingestion of the plant. There is extreme cerebral disturbance, incoordination and muscle spasms. The affected animal may become frenzied, run aimlessly or throw itself violently about. It may butt other animals or stand with its head pressing against a tree or other solid object. Respiratory distress, depression and prostration precede death. Temperature remains normal throughout the course of toxicity. No pathognomonic lesions are found at autopsy.

7.2.5 Treatment. There is no successful treatment known at this time.

7.2.6 Prevention. Animals will seldom eat enough to produce poisoning if other forage is available. They should be kept away from patches in late summer when the plant is highly toxic and from dense plant stands at all times. Supplemental feed is required when passing through lupine ranges. Actively growing plants should be sprayed with 2,4-D or 2,4,5-T before they bloom.

7.3 PROSOPIS JULIFLORA (SW.) (D.C.) (Mesquite)

7.3.1 Description. Mesquite is a many-branched shrub or small tree, 15 to 20 feet tall. It is sometimes so largely buried under the sand of dunes that only 2 to 3 feet of the brownish branch tips protrude. Its long roots may penetrate 50 to 60 feet to moisture, and it flowers from April to June. [12]



7.3.2 Distribution and Habitat. Mesquite is found in sandy dry ranges, washes, and in draws at low elevations, especially along streams and where the water table is high. [15] It is fairly common in the Larrea Franseria plant community between 3000 to 4000 ft. in elevation and at Cane Springs on the Nevada Test Site. [5]

7.3.3 Poisonous Principle. The poisonous principle is unknown. However, it is believed that the high sucrose content of the beans alter rumen bacteria flora to such an extent that cellulose cannot be synthesized. [16] Animals most likely affected would be cattle during the spring and summer months.

7.3.4 Symptomatology and Pathology. Ingestion over an extended period of time results in rumen stasis and impaction with associated symptoms and death. Symptoms characteristic of malnutrition are emaciation, excessive salivation, sublingual and submaxillary edema. Terminal stages may be characterized by nervousness and muscular twitching, especially about the head.

On autopsy, the rumen is found to be full of mesquite pods and seeds. There is a severe anemia. The liver and kidneys show marked degenerate changes.

7.3.5 Treatment. There is no specific treatment. The animals should be removed from range and given rumen stimulants and laxatives.

7.3.6 Prevention. The best preventive measure is to provide desirable forage.

Chapter 8

LILIACEAE

8.1 ZYGADENUS VENENOSUS (WATS) (Deathcamas)

8.1.1 Description. The leaves are V-shaped in cross section and originate in a bulb, 4 to 6 inches underground. Late in May, the plant sends up a single 6 to 12 inch stalk, which terminates in a close cluster of very small cream-colored flowers. The grass-like leaves wither after blossoming.[20]

8.1.2 Distribution and Habitat. Deathcamas comes up in early May or June with the first grass, growing in meadows and foothills at elevations above 5000 ft. This species is occasional to common on the Nevada Test Site in the Artemisia-Pinon-Juniper plant communities.[5]

8.1.3 Poisonous Principle. Toxicity of this plant is due to alkaloids that are classified as steroid alkaloids of the veratrum group. More sheep are lost on early spring ranges from the ingestion of this species than from any other poisonous plant. In general, the losses from deathcamas results from too early use of over use of spring ranges. Cattle and horses are occasionally poisoned under such range conditions.[16]

8.1.4 Symptomatology and Pathology. The average minimum toxic doses expressed as percent of the animal's weight of green plant that will result in mild transient symptoms and death are 0.4% and 2%

respectively. Excessive salivation is the first symptom noted, which is usually followed by increased respiration, nausea, vomiting, weakness and staggering. Animals develop convulsions followed by coma terminating in death. Cattle and horses show the same symptoms as do sheep.

There are no significant lesions on autopsy.

8.1.5 Treatment. Subcutaneous injection of 2mg atropine sulphate and 8mg picrotoxin in 5cc of water per 100 lbs. of weight should be given every 8 hours until recovery.

8.1.6 Prevention. Because it is not feasible to eradicate the plant, herding away from plant areas and/or grazing the range late in the season are the most practical solutions.

Chapter 9
POLYGONACEAE

9.1 RUMEX CRISPUS L. (Rhubarb)

9.1.1 Description. This plant is an herb that has alternate, mostly entire leaves, and petioles sheathing the stem. Flowers are small, numerous, and greenish in color. The fruit is an achene with a papery, three-winged covering.[16]

9.1.2 Distribution and Habitat. Rhubarb is a common plant of acid or sterile, gravelly soils of pastures and meadows at elevations up to 6500 ft.[16] This species has been found growing in moist to wet sites at Cane Springs and Whiterock Springs on the Nevada Test Site.[5]

9.1.3 Poisonous Principle. Rhubarb toxicity is produced by soluable oxalates and is usually observed in the spring and summer months. Several cases of poisoning in sheep have occurred during this period in which species of Rumex were suspected.[16]

9.1.4 Symptomatology and Pathology. Symptoms and lesions of affected animals are identical to those described under section 2.3.4.

9.1.5 Treatment. Comments made in section 2.3.5 apply to this plant.

9.1.6 Prevention. Comments made in section 2.3.6 also apply.

Chapter 10

RANUNCULACEAE

10.1 DELPHINIUM PARISHII (GRAY) (Larkspur)

10.1.1 Description. This species is about one to two feet high. The blue flowers have a characteristic prominent spur.[23] The leaves appear ragged because they are made up of irregular divisions radiating from the center. The plant germinates very early in the spring and first appears as little green clumps of leaves. Later in the spring the deep-blue flowers shoot up above the leaves in one or more spikes from 12 to 18 inches high.[8]

10.1.2 Distribution and Habitat. It grows on open hillsides, benches and sagebrush deserts[26] in sandy to sandy loam soils. It is most prevalent during the spring and summer months at elevations between 4500 and 6000 ft. This species is listed as being occasional to common in the Larrea, Grayia Lycium, Coleogyne and Artemisia plant communities in all basins throughout the Nevada Test Site.[5]

10.1.3 Poisonous Principle. The poisonous principles are complex diterpenoid alkaloids. Larkspur is dangerous from the time the plants are sufficiently large to be grazed until they turn brown and begin to wither. It appears to be a little more poisonous before blooming than after it is in full bloom. Feeding tests show that leaves, stems, flowers, and pods are poisonous, but that under range conditions, roots are not dangerous.[8]

In an experimental feeding test where large quantities of larkspur were placed before cattle, it was observed that the plant is much more attractive to some cattle than to others. Some animals would readily and quickly eat a quantity of it sufficient to produce death while others, after days of starvation, would eat only small quantities. These tests indicate that on the range, the danger from larkspur poisoning does not depend entirely upon abundance of the plant, but also upon the physical condition of the cattle, their appetite for the plant, and the condition of the range.

10.1.4 Symptomatology and Pathology. Sheep are much less susceptible to larkspur poisoning than cattle. In cattle, consumption of half a pound of the plant per 100 lbs. of body weight will cause poisoning. Affected animals show excessive salivation, frequent swallowing, depressed heart rate, struggling, sudden falling, and tetaniform seizures. Constipation is a constant symptom. Death is caused by respiratory paralysis or by asphyxiation which may follow the aspiration of rumen contents.

Lesions are not specific consisting of wide-spread venous congestion and gastrointestinal inflammation.

10.1.5 Treatment. Treatment is generally ineffective because of the high degree of toxicity. Sixty milligrams of physostigmine salicylate and 120 mg of pilocarpine hydrochloride and 20cc of water given subcutaneously is sufficient for a 500 lb. animal.

10.1.6 Prevention. The use of larkspur range for sheep during the spring and summer is a good management practice as larkspur ranges that have been cleaned out by sheep may be later grazed by cattle. Control in small areas can be done by mechanical grubbing

and spraying of herbicides. Supplementing the animal's diet with high protein feed will aid in decreasing the hunger for succulent green plants, thereby indirectly preventing the ingestion of toxic amounts of larkspur.

Chapter 11
SOLANACEAE

11.1 DATURA METELOIDES DUNAL (Western Jimson Weed)

11.1.1 Description. Western Jimson Weed is a large conspicuous grayish green perennial forming spreading clumps. The coarse grayish stems are erect but spreading, branched from the base 2 to 3 feet high. The large ovate leaves are alternate, on stout grayish stocks 1 to 5 inches long. The large showy flowers are white or pale lavender, short stocked and very fragrant. They are broadly funnel-shaped, 6 to 10 inches long and 3 to 6 inches across, with 5 slender teeth 1/2 to 3/4 inch long.[3]

11.1.2 Distribution and Habitat. It is commonly found growing at elevations from 1000 to 7000 ft. in sandy soils. Plants are usually found along roadsides, washes, arroyos and on gentle slopes. This particular species grows in Forty-mile Canyon on the Nevada Test Site.

11.1.3 Poisonous Principle. Toxicity is due to several solanaceous alkaloids of the tropane configuration, which include atropine, hyoscyamine and hyoscine. Total alkaloid content is high, varying between 0.25 and 0.7 percent of the plant. All parts of the plant are poisonous; the seeds being the most toxic. Losses have been reported in all classes of livestock during the spring and summer months.[16]

11.1.4 Symptomatology and Pathology. Ten to 14 ounces of the green plants (0.06 to 0.09 percent of the animal's weight) are usually lethal to cattle.[16] However, the amount of green plants necessary to produce toxicity may vary with climatic and seasonal factors. Symptoms of poisoning are essentially those observed following an overdose of atropine. There is dryness of the oral mucous membrane, increased thirst, nausea, and disturbed vision. Effects on the central nervous system result in muscular twitching, incoordination, vertigo, hallucinations and mania. There is increased respiration and the heart beat is rapid and weak. During the final stages, the respiration becomes slow, weak, and irregular. Convulsions and coma precede death which results from asphyxiation.

Lesions of Datura toxicity are not specific. The alkaloids can be detected in the urine of a poisoned animal by placing a drop of the urine in the eye of a laboratory animal. If the alkaloids are present, the pupil will be dilated.

11.1.5 Treatment. The first step in treatment is the removal of the ingesta by gastric lavage. Oral administration of tannic acid or potassium iodide will precipitate the alkaloids. Symptomatic relief may be given by the administration of cardiac and respiratory stimulants. If dyspnea is present, the use of oxygen is quite helpful.

11.1.6 Prevention. Under normal range conditions, this plant will cause little trouble as animals will not eat it unless forced to through starvation and confinement within heavily infested pastures or corrals. In small areas the plant may be easily controlled by grubbing.

11.2 NICOTIANA ATTENUATA (TORR.) (Wild Tobacco)

11.2.1 Description. This is an erect, branching herbaceous annual. The stems are hairy, sticky, and grow to a height of four feet. The leaves are alternate 1-1/2 to 4 inches long. Flowers are long-tubular, five parted and white in color.[16]

11.2.2 Distribution and Habitat. This species is found in dry sandy stream beds up to 5500 ft. in elevation. On the Nevada Test Site, it is commonly seen on disturbed sites in the Artemisia - Pinon-Juniper plant communities. Small populations are occasionally seen in moist areas at lower elevations.[5]

11.2.3 Poisonous Principle. The alkaloid nicotine has been demonstrated, and it is generally assumed that nicotine is the poisonous principle. Poisoning has been reported in all classes of livestock during the spring and summer months.[16]

11.2.4 Symptomatology and Pathology. The minimal lethal dose on a green weight basis, has been found to be approximately 2% of the animal's weight.[16] Symptoms are neurogenic in origin. Immediately after ingestion there is salivation, nausea, vomiting, diahrrea and abdominal pains, muscular weakness, convulsions, tetanic spasms, muscle twitching, collapse and loss of reflexes. The pulse is feeble, extremities are cold and there is an increase in respiratory rate. Death may occur quickly.

No specific lesions other than those usually associated with anoxia are found. There may be aspirated ingesta in the trachea and lungs.

11.2.5 Treatment. There is no specific treatment. Respiratory stimulants and artificial respiration should be given. Oral dosing with tannic acid may precipitate the alkaloid and retard further absorption.

11.2.6 Prevention. This plant is relatively unpalatable. Proper range management should prevent its becoming a problem. Herbicide application and grubbing of plant concentrations will aid in control of the plant.

11.3 NICOTIANA TRIGONOPHYLLA (DUNAL) (Desert Tobacco)

11.3.1 Description. This is a slender, erect, herbaceous annual. The stems are hairy, sticky and grow to a height of three feet. The leaves are alternate two to five inches long. The flowers are white to yellowish and open during the day time.[16]

11.3.2 Distribution and Habitat. It is found in dry desert soils usually below 4500 ft. in elevation and is common in the Larrea-Franseria plant community and throughout the lower basins of the Nevada Test Site.

11.3.3 Poisonous Principle. Nicotine has been demonstrated and is assumed to be responsible for the toxic effects. Poisoning has been reported in all classes of livestock during the spring and summer months.

11.3.4 Symptomatology and Pathology. Nicotiana trigonophylla is more toxic than Nicotiana attenuata. Symptoms and lesions are the same as described in section 11.2.4.

11.3.5 Treatment. Comments made in section 11.2.5 apply to this plant.

11.3.6 Prevention. Comments made in section 11.2.6 apply here.

Chapter 12

TYPHACEAE

12.1 TYPHA LATIFOLIA L. (Cattail)

12.1.1 Description. Common cattail is a perennial marsh herb having erect, unjointed pithy stems and grows from 4 to 7 feet high. It has alternate grass-like leaves, which terminate in dense flower clusters.[21]

12.1.2 Distribution and Habitat. It is found in moist soils, marshes and ponds. On the Nevada Test Site, this species was noted at Whiterock Springs at an elevation of about 5000 ft.[5]

12.1.3 Poisonous Principle. The toxic principle is unknown. It has been suspected of being toxic to horses.[16] This species is toxic during all seasons of the year.

12.1.4 Symptomatology and Pathology. Cattails are reported poisonous to stock when eaten in large quantities. Symptoms include stiffness, disinclination to move, profuse perspiration and muscular trembling.

There are no specific lesions. Presence of large amounts of the plant in the rumen or stomach content should make one suspicious of this plant.

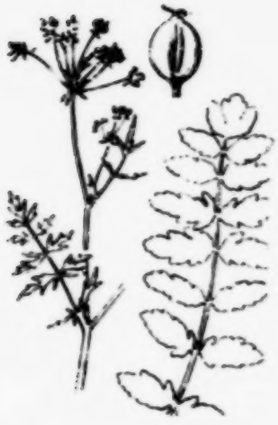
12.1.5 Treatment. There is no specific treatment.

12.1.6 Prevention. No specific preventive measures are recommended. Livestock should be supplied with water sources that are not infested with cattails or areas of infestation should be fenced.

Chapter 13
UMBELLIFERAE

13.1 BERULA ERECTA (HUDS.) COV. (Water Parsnip)

13.1.1 Description. This plant is an erect branching shrub 1/2 to 2 feet high. The leaflets are ovate to oblong and are 1 to 2-1/2 inches long. The flower is white in color.[13]



13.1.2 Distribution and Habitat. Water parsnip is usually found along waterways and in wet habitats. It grows in shallow water at Cane Spring pond[5], which is at an elevation of about 4000 ft.

13.1.3 Poisonous Principle. This species was circumstantially incriminated in losses of cattle in Canada, and on the basis of this report it must be regarded as a minor problem to the livestock industry. The poisonous principle has not been isolated.[16]

13.1.4 Symptomatology and Pathology. There is no information in the literature as to symptoms, lesions, treatment or prevention.

13.1.5 Treatment. Refer to statement in section 13.1.4.

13.1.6 Prevention. Refer to statement in section 13.1.4.

Chapter 14

ZYGOPHYLLACEAE

14.1 TRIBULUS TERRESTRIS L. (Puncture Vine)

14.1.1 Description. This is a prostrate, trailing vine extending out as much as six feet.[17] The hairy branches radiate from a slender taproot. When support is available, the plant readily becomes a scrambler or climber. The leaves are mostly opposite and compound. The flowers are produced singly on long stalks arising from the axils of the leaves. This plant is readily recognized by the two horned fruit which is very abundant in infested areas.[11]

14.1.2 Distribution and Habitat. It is commonly seen on sandy dry soils along roadsides and where the soil has been disturbed. It is part of the Larrea-Franseria plant community at 2000 to 4000 ft. elevation.

14.1.3 Poisonous Principle. Steroidal saponins are the cause of this species' toxicity.[16] Grazing animals affected are cattle and sheep especially during the spring and summer months. Morbidity averages 10 to 30% although mortality may be as high as 90% in the affected animals.

14.1.4 Symptomatology and Pathology. This plant causes photosensitization and resulting "Bighead" in sheep. Symptoms appear 48 to 72 hours after consumption of the plant. The animal shows the same

symptoms as listed in section 3.8.4 as well as icteric discoloration in the mucous membranes and skin. Keratitis may develop followed by opacity and rupture of the cornea.

Lesions found include subcutaneous edematous swelling of the head which contain yellow serum. The liver is enlarged, yellow, and shows fatty degeneration. Kidneys are olive green in color and show fatty degeneration. Fatty changes are also seen in the myocardium.

14.1.5 Treatment. Animals should be removed from the range and kept in the shade. Antihistamines will aid in reducing the severity of the symptoms.

14.1.6 Prevention. The best preventive measure is proper range management so that more palatable plants are available. Herbicide applications may be of value on some ranges.

APPENDIX

TABLES I-VI

The following tables provide additional information concerning poisonous plants. The tables are keyed to the text for easy reference; the decimal numbers in the columns refer to the numbered paragraph or section where the plant is described.

TABLE I. AVERAGE HEIGHTS OF POISONOUS PLANTS

Below 12"	12"-24"	24"-36"	36"-48"	48"-60"	60"-72"	Above 72"
3.5	2.3	2.2	3.10	2.1	12.1	5.1
6.1	3.1	3.6	9.1	2.4		7.3
14.1	3.3	3.8	11.2	3.2		
	3.4	3.9				
	3.7	4.2				
	4.1	11.1				
	7.1	11.3				
	7.2					
	8.1					
	10.1					
	13.1					

TABLE II. LEAF FORMS OF POISONOUS PLANTS

Bipinnate	Cuneate	Dentate	Lobed	Grass-Like	Lanceolate
4.1 6.1	10.1	3.5	5.1	8.1 12.1	4.2 11.2 11.3

Linear	Oblanceolate	Oblong	Obovate	Ovate	Pinnatifid
2.1 2.3 2.4 3.2 3.3	3.4 3.7 3.8 3.9 3.10 7.3	7.2	9.1 13.1 14.1	7.1	2.2 3.6 11.1	3.1

TABLE III. DANGEROUS SEASONS OF POISONOUS PLANTS

Spring	Summer	Fall	Winter	Yearlong
2.1	2.1	2.3	2.3	12.1
2.2	3.1	3.8	6.1	
2.3	3.2	3.9		
2.4	3.3	6.1		
3.1	3.4	7.2		
3.2	3.5			
3.3	3.6			
3.4	3.7			
3.5	3.8			
3.6	3.9			
3.7	3.10			
3.8	4.1			
3.9	4.2			
3.10	6.1			
4.1	7.2			
4.2	7.3			
5.1	9.1			
6.1	10.1			
7.1	11.1			
7.2	11.2			
7.3	11.3			
8.1	13.1			
9.1	14.1			
10.1				
11.1				
11.2				
11.3				
14.1				

TABLE IV. POISONOUS PRINCIPLES FOUND IN PLANTS

Selenium	Locoine	Alkaloids	Saponin	Oxalates	Nicotine	Tannin	Unknown
2.1	7.1	3.6	3.3	2.3	11.2	5.1	3.1
2.2		3.7	14.1	2.4	11.3		3.2
3.4		6.1		9.1			3.5
4.2		7.2					3.8
		8.1					3.9
		10.1					3.10
		11.1					4.1
							7.3
							12.1
							13.1

TABLE V. SPECIES OF ANIMALS AFFECTED BY POISONOUS PLANTS

Cattle	Sheep	Horses	Goats	Swine	All
3.3	3.1	7.2	3.1	7.2	2.1
3.4	3.3	12.1	3.4		2.2
4.1	3.4		7.2		2.3
5.1	3.5				2.4
6.1	3.8				3.2
7.2	3.9				3.6
7.3	3.10				3.7
10.1	5.1				4.2
13.1	6.1				7.1
14.1	7.2				8.1
	9.1				11.1
	14.1				11.2
					11.3

TABLE VI. SYMPTOMATOLOGY OF POISONED ANIMALS

Excessive Salivation	Depraved Appetite	Incoordination and Convulsions	Aimless Wandering and Hyperexcitability	Blindness	Respiratory Distress	Abdominal Pain	Icterus
7.3	2.1	2.1	2.1	2.1	2.3	2.1	3.3
8.1	2.2	2.2	2.2	2.2	2.4	2.2	3.5
10.1	3.4	3.1	3.6	3.4	4.2	2.3	3.6
11.2	3.6	3.8	3.7	3.8	7.2	2.4	3.7
11.3	3.7	3.9	4.1	3.9	8.1	3.4	14.1
	4.2	3.10	4.2	3.10	9.1	3.6	
		6.1	7.1	4.1	11.1	3.7	
		7.1	7.2	4.2	11.2	4.2	
		7.2	11.1	14.1	11.3	9.1	
		10.1				11.2	
		11.1				11.3	
		11.2					
		11.3					
		14.1					

Hemoglobinuria	Frothy Green Slobber	Emaciation and Malnutrition	Stiffness and Lameness	Hoof Deformities and Hair Loss	Photosensitization	Constipation	Abortion
3.1	3.1	3.6.4	2.1	2.1	3.8	5.1	3.3
3.3		3.7.4	2.2	2.2	3.9	10.1	7.1
		4.1	3.4	3.4	3.10		
		7.1	4.2	4.2	14.1		
		7.3	12.1				

GLOSSARY

Achene..... one seeded fruit
Albuminuria..... presence of albumin in the urine
Alternate..... located singly at a node, as leaves on a stem
Anemia ..... a deficiency of red blood corpuscles
Annual..... plant that completes its life cycle in one year
Anorexia..... loss of appetite
Artemisia..... genus name of sagebrush, sunflower family
Ascites ..... serous fluid in the peritoneal cavity
Aspiration..... to draw in or out as by suction
Atrophy..... wasting due to lack of nutrition
Bracts..... modified leaf subtending a flower
Chaparral..... evergreen shrub type
Cirrhosis ..... an interstitial inflammation with connective tissue deposition, i.e., scar formation
Coleogyne..... genus name of blackbrush, rose family
Compound..... leaves composed of two or more parts
Congenital..... occurring during fetal life, not hereditary
Cystitis..... inflammation of the urinary bladder
Desquamation..... scaling of the skin or cuticle
Diffuse..... spread, scattered
Dysfunction..... abnormality or impairment of function
Dyspnea..... labored or difficult breathing
Edema..... condition where the body tissues contain an excessive amount of fluid
Emaciation..... state of being extremely lean
Emphysema ..... distention of tissues by gas or air
Enteritis..... inflammation of the intestines
Filiform ..... threadlike
Franseria..... genus name of bunobush, sunflower family
Friable ..... easily broken
Gastroenteritis ..... inflammation of the stomach and bowels
Gestation..... period of development from conception to birth
Glomerulonephritis.. inflammation of the kidneys, primarily of the glomeruli
Hematuria..... blood in the urine
Hemorrhagic ..... marked by hemorrhage (escape of blood from the vessels)
Hepatic ..... pertaining to the liver
Herbaceous..... non woody
Histopathology..... study of diseased tissues
Hydrops..... dropsy or edema

Hyperemia..... unusual amount of blood with distention of blood vessels

Hyperexcitability.... excessive excitement

Inappetence..... loss of appetite or desire

Ingesta..... food or drink

Keratitis ..... inflammation of the cornea

Larrea..... genus name of creosote bush, caltrop family

Mania..... a mental disorder distinguished by excessive excitement or enthusiasm; violent desire or passion

Mydriatic..... pertaining to dilation of the pupil of the eye

Necropsy..... examination of a dead body

Necrosis ..... death of tissue or bone

Nephritis..... inflammation of the kidney

Neurogenic ..... of nervous origin, stimulated by the nervous system

Opacity..... lack of transparency

Opposite..... leaves in pairs one on either side of the node

Pathognomonic ..... characteristic symptom of a disease, distinguishing it from other diseases

Perennial..... plant that continues to live year after year

Pericardium..... fibroserous sac enclosing the heart

Petechial..... presence of small hemorrhage on a surface such as the skin

Prophylaxis..... observance of rules necessary to prevent disease

Pubescence..... covered with hairs

Scurfy..... covered with minute scales

Spike..... elongated inflorescence of sessile or subsessile flowers

Subcutaneous..... beneath the skin, hypodermic

Syndrome..... a group of symptoms which, when considered together, characterize a disease or lesion

Tenesmus ..... spasmodic contraction of anal or vesical sphincter

Tepid ..... slightly warm, lukewarm

Tetaniform ..... resembling tetanus

Tomentum..... a covering of woolly matted hairs

Vertigo..... a whirling around

Vulvar ..... pertaining to the external female genitalia

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Figure 165, p. 80 — Typha latifolia. Broad-leaved Cattail.
923, p. 377 — Zygadenus venenosus. Deadly Zygadene or Death-camas.

Ibid. VOLUME II, Buckwheats to Kramerias, 1944. Stanford University Press. Copyright 1944 by the Board of Trustees of the Leland Stanford Junior University.

Figure 1433, p. 52 — Rumex crispus. Curley-leaved or Yellow Dock.
1506, p. 80 — Atriplex rosea. Red Orache or Saltbush.
1535, p. 88 — Atriplex canescens. Hoary Saltbush.
1549, p. 93 — Sarcobatus vermiculatus. Greasewood.
1798, p. 192 — Delphinium parishii. Parish's Larkspur.
1916, p. 237 — Corydalis aurea. Golden Corydalis.
1921, p. 241 — Stanleya pinnata. Golden Prince's Plume, Desert Plume
2005, p. 272 — Descurainia pinnata subsp Menziesii. Western Tansy Mustard.

Figure 2591, p. 501 Lupinus caudatus. Kellogg's Spurred Lupine.
2878, p. 604 Astragalus lentiginosus. Mottled Rattleweed.

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Figure 3003, p. 15 Tribulus terrestris. Land Caltrop of Puncture Weed.
3502, p. 232 Berula erecta. Cut-leaved Water Parsnip.
4512, p. 679 Nicotiana trigonophylla. Desert Tobacco.
4513, p. 685 Nicotiana attenuata. Coyote Tobacco.

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Figure 5317, p. 197 Baileya multiradiata. Wild Marigold.
5430, p. 261 Gutierrezia sarothrae. Common Matchweed or Snakeweed.
5431, p. 261 Gutierrezia microcephala. Small-headed Matchweed.
5511, p. 302 Chrysothamnus nauseosus. Common Rabbitbrush.
5745, p. 435 Senecio spartiodes. Narrow-leaved Butterweed.
5752, p. 437 Senecio integerrimus var. exaltatus. Single-stemmed Butterweed.
5796, p. 457 Psathyrotes annua. Mealy Rosettes.
5805, p. 463 Tetradymia canescens. Spineless Horsebrush.
5806, p. 463 Tetradymia glabrata. Little-leaf Horsebrush.